

# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NIPPON SHEET GLASS CO LTD

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(72)Inventor : KOMAZAWA SOURIYO  
SUZUKI KOICHI  
SUGANO ATSUYA

Priority

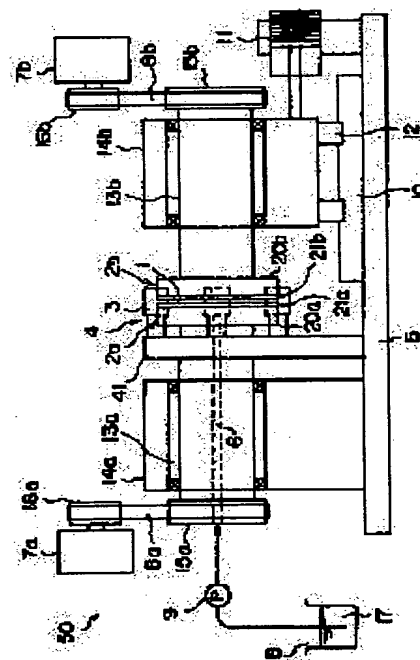
Priority number : 11136919 Priority date : 18.05.1999 Priority country : JP

## 1) BOTH SURFACE POLISHING DEVICE AND METHOD

7)Abstract:

**PROBLEM TO BE SOLVED:** To increase a polishing speed and grind the whole of the surface of a glass disc with an uniform margin by a method wherein both surfaces of a glass disc further increased in thickness are simultaneously polished and a polishing method is made suitable for the glass disc for a magnetic recording medium.

**SOLUTION:** The both surfaces of the surface and the back of a glass disc having an outer periphery with a diameter D1 of 65 mm and an inner periphery with a diameter D2 of 20 mm are pressed in a nipped state against a pair of rotary polishing bodies 2a and 2b for simultaneous polishing. In a polishing method described above, the glass disc is held by a rotational attitude holding means 4 and the glass disc is forcibly rotated, and polishing is executed by using a rotary polishing body with a diameter D of, for example, 70 mm (having a relation of  $D > D1 - D2$ ) having a rotary axis paralleling the rotary axis of the glass disc, the rotary polishing device serving as a pair of the rotary polishing bodies 2a and 2b.



## GAL STATUS

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 AIMS
 

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aim(s)]

aim 1] Front flesh-side both sides of the ground disk which has the periphery of a diameter D1, and the inner circumference of a diameter D2 While being the double-sided polish approach of the ground disk which sandwiches and mates with the barrel-polishing object of a pair which was made to counter both sides of said ground disk, and was polished, and is ground to coincidence, and holding said ground disk with a vertical posture maintenance means and driving out forcible rotation The double-sided polish approach of the ground disk characterized by the revolving-shaft alignment using the barrel-polishing object of said pair as the barrel-polishing object of the diameter D ( $D > D1 - D2$ ) which has a revolving-shaft alignment parallel to the revolving-shaft alignment of said ground disk.

aim 2] The double-sided polish approach of the ground disk according to claim 1 characterized by making the impulsive rotational frequency of said ground disk larger than the rotational frequency of the barrel-polishing object of said pair.

aim 3] The double-sided polish approach of the ground disk according to claim 1 or 2 characterized by having changed the revolving-shaft alignment of the barrel-polishing object of said pair on the outside of the periphery of said ground disk.

aim 4] A means to hold the ground disk which has the periphery of a diameter D1, and the inner circumference of a diameter D2 into a vertical posture, The means which carries out forcible rotation of said ground disk, and the barrel-polishing object of the pair which is arranged so that it may face across both sides of said ground disk, and has a revolving-shaft alignment parallel to the revolving-shaft alignment of said ground disk, A means to show at least one side of the barrel-polishing object of said pair to spite said ground disk, Double-sided polish equipment which it is double-sided polish equipment which has the rotation drive of the barrel-polishing object of said pair, and the diameter of the barrel-polishing object of said pair is  $D > D1 - D2$ , and is characterized by arranging those revolving-shaft alignments on the outside of the periphery of said ground disk.

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## TAILED DESCRIPTION

Tailed Description of the Invention]

01]

Field of the Invention] This invention relates disks, such as a metal, ceramics, and glass, to grinding, the approach of grinding, and its equipment at coincidence using the barrel-polishing object of a pair. This invention especially relates to suitable polish approach for the glass disk and aluminum disk which are used for a magnetic-recording medium, and polish equipment.

02]

Description of the Prior Art] As an approach of grinding front flesh-side both sides of a glass disk to coincidence using a glass disk with the barrel-polishing object of the pair which holds a glass disk into a vertical posture with the rotation roller of the shape of three cylinder, and has a diameter smaller than the diameter of the glass disk in JP,6-10560,A. While rotating a barrel-polishing object, it is made to reciprocate to the circumference of the revolving-shaft alignment in alignment with the axial center of a glass disk, and the approach and equipment which grind front flesh-side both sides of a glass disk to coincidence are indicated.

03] Moreover, as it is made not to carry out the neck swing of one side to JP,61-10275,B to the revolving shaft of a barrel-polishing object among the barrel-polishing objects of a pair and the neck swing of another side is carried out to it the revolving-shaft alignment of a barrel-polishing object with a universal joint, the approach and equipment which grind front flesh-side both sides of the ground body are indicated, and it is [0004].

Problem(s) to be Solved by the Invention] By the approach indicated by JP,6-210560,A, since the diameter of a barrel-polishing object is smaller than the diameter of the ground body, and in order to make a barrel-polishing object reciprocate to the circumference of the revolving-shaft alignment in alignment with the axial center of a ground disk and grind it, the size of a polish rate arose by the location of a ground disk, and the technical problem that it was difficult to carry out polish processing of the whole field of a ground disk uniformly at a high speed occurred.

05] Moreover, by the approach indicated by JP,61-10275,B, one side of a barrel-polishing object is held by \*\*\*\*, about another side, since the ground body is ground for the barrel-polishing object as a neck swing device to a revolving-shaft alignment with the universal joint, distribution of the pressure concerning the ground body does not become homogeneity. For this reason, the technical problem that it is difficult to grind the whole field to the ground body to homogeneity occurs. Furthermore, in order that the ground body might carry out flattery rotation with a barrel-polishing object, the technical problem which should be solved practically that a polish rate was low occurred.

06]

Means for Solving the Problem] The double-sided polish approach of this invention made in order to solve the above-mentioned technical problem Front flesh-side both sides of the ground disk which has the periphery of a diameter D1, and the inner circumference of a diameter D2. While being the double-sided polish approach of the ground disk which sandwiches and insinuates with the barrel-polishing object of a pair which was made to counter both sides of said ground disk, and was established, and is ground to coincidence, and holding said ground disk with a vertical posture maintenance means and carrying out forcible rotation. It is the double-sided polish approach of the ground disk characterized by the revolving-shaft alignment using the barrel-polishing object of said pair as the barrel-polishing object of the diameter D ( $D > D1 - D2$ ) which has a revolving-shaft alignment parallel to the revolving-shaft alignment of said ground disk.

07] It is a large polish rate to make it larger than the rotational frequency of the barrel-polishing object of a pair, and the compulsive rotational frequency of a ground disk has it, when grinding by uniform thickness over the whole ground disk. [desirable]

08] Moreover, the revolving-shaft alignment of the barrel-polishing object of a pair is desirable when arranging on

outside of the periphery of a ground disk grinds by uniform thickness over the whole ground disk.

09] A means to hold the ground disk by which the polish equipment of this invention has the periphery of a diameter and the inner circumference of a diameter D2 into a vertical posture, The means which carries out forcible rotation of said ground disk, and the barrel-polishing object of the pair which is arranged so that it may face across both sides of said ground disk, and has a revolving-shaft alignment parallel to the revolving-shaft alignment of said ground disk, A means to show at least one side of the barrel-polishing object of said pair to spite said ground disk, It is double-sided polish equipment which has the rotation drive of the barrel-polishing object of said pair, and the diameter D of the barrel-polishing object of said pair is  $D > D1 - D2$ , and it is characterized by arranging those revolving-shaft alignments on the outside of the periphery of said ground disk.

10]

[Embodiment of the Invention] The gestalt of operation of this invention is explained based on drawing 1 - drawing 4. Drawing 1 is the general drawing of one example of the double-sided polish equipment of this invention. The double-sided polish equipment 50 of this invention contains barrel-polishing object 2a arranged at a stand 5, a vertical posture maintenance means 4 to hold the ground disk 1 arranged in the center section of this stand 5 into a vertical posture, and the both sides of this attaching part 4, and 2b.

11] Barrel-polishing object 2a of a pair and 2b are arranged on the stand 5 so that it may face across both sides of the ground disk 1 held with the roller 3 at the vertical posture, and the revolving-shaft alignment may become the revolving-shaft alignment of the ground disk 1, and parallel.

12] Barrel-polishing object 2a is being fixed to revolving-shaft barrel 13a supported pivotable by bearing object 14a fixed to the stand 5. Rotation of electric motor 7a fixed by support (not shown) is told to barrel-polishing object 2a through belt 8a which connects pulley 15a attached in the edge of pulley 16a attached in the revolving shaft of an electrical motor, and pulley 16a and revolving-shaft barrel 13a. In the revolving shaft of revolving-shaft barrel 13a and pulley 15a, the polish liquid feed holes 6 for supplying the polish liquid 17 in a storage tank 18 to the interior of barrel-polishing object 2a with the transportation pump 9 are formed.

13] Barrel-polishing object 2b is being fixed to revolving-shaft barrel 13b currently supported pivotable by bearing object 14b supported by the slider section 12 which moves while sliding on the rail 10 top prepared in the stand 5 at a longitudinal direction. Rotation of electrical-motor 7b is told to barrel-polishing object 2b through belt 8b which connects pulley 16b attached in the edge of pulley 16b attached in the revolving shaft of an electrical motor, and pulley 16b and revolving-shaft barrel 13b.

14] A means to show at least one side of barrel-polishing object 2a of a pair and 2b to spite the ground disk 1 is established. This insinuating remark means will not be limited especially if it has the function which presses the barrel-polishing object 2 against the polished surface of the ground disk 1 by the predetermined pressure. In drawing 1, the roller section 12 supporting the bearing object 14, the rail 10 which makes the slider section 12 slide to a longitudinal direction, and the thing which consists of press equipment 11 which has a pneumatic cylinder are shown. Approach and separation of barrel-polishing object 2b are enabled by motorised [ of press equipment 11 ] at the ground disk 1, and it is insinuated by the ground disk 1 by the suitable pressure by it.

15] In drawing 1, barrel-polishing object 2a is fixed to a longitudinal direction, and barrel-polishing object 2b is shown to spite a longitudinal direction, and is movable by the means. The ground disk 1 is insinuated in the state of press with the barrel-polishing object 2 which the pair is rotating, polish liquid is supplied in the state of this press, and a grinding process and polish processing are performed. The ground disk 1 is inserted into the peripheral face with at least two rollers, and the vertical posture maintenance means 4 of the ground disk 1 is held.

16] Drawing 2 is drawing showing the gestalt of 1 operation of the vertical posture maintenance means 4 of the ground disk 1 of the double-sided polish equipment of this invention, and the motor 19 for compulsive rotation. The addition of being held by roller 3d which carries out forcible rotation of Rollers 3a, 3b, and 3c and one ground disk which were attached in drawing 2 (a) free [ three rotations ] is shown. The dimension of the thickness (direction perpendicular to space) of each roller 3 is fully larger than the dimension of the thickness of the ground disk 1. The slot larger width of face a little than the thickness of the ground disk 1 may be established in the peripheral face of each roller 3 in order to make easy installation of removal from the maintenance means of the ground disk 1, or a maintenance means. Through the migration metallic ornaments 43 attached movable as slid on the rib 42 along the die-length direction, the rollers 3a and 3c of two tops are supported so that the revolving-shaft alignment of each roller may come level with dummy support 44. The lower rollers 3b and 3d are attached in the stanchion 41.

17] The gestalt of 1 operation of the means which carries out forcible rotation of the ground disk 1 of this invention shown in drawing 2 (b). A roller 3d shaft is connected with the motor 19 for compulsive rotation, and forcible rotation carried out by rotation of roller 3d at a predetermined rotational frequency. Compulsive rotation of the ground disk 1

performed by the motor for compulsive rotation attached in at least one roller.

[18] Drawing 3 is drawing for explaining the physical relationship of the revolving-shaft alignment of the ground disk which has the diameter D2 of inner circumference and the diameter D1 of a periphery concerning this invention, and barrel-polishing object 2. The condition that the ground disk 1 was inserted into the peripheral face of three rollers 3b, and 3c by the peripheral face, and was held at the vertical posture is shown in drawing 3. The revolving-shaft alignment of one barrel-polishing object 2a is set to  $D > D1 - D2$ , when it can be moved in parallel with the revolving-shaft alignment of the ground disk 1, and can be made into what can adjust distance a and the diameter of barrel-polishing object 2a is set to D.

[19] What stuck the scouring pad on metal or the surface plate made from the ceramics, and the thing which stuck the diamond wheel of predetermined grain size on the front face of a surface plate can be used for the barrel-polishing object 2 used for this invention. Drawing 4 (a) and drawing 4 (b) are the top views and sectional views of a gestalt of a barrel-polishing object which can be used for this invention. [ of one example ] In drawing 4 (a), the slot 22 connected with the polish liquid feed holes 6 at one side of the metal disk 20 is established in the radial toward the periphery of a surface plate. A slot 22 is good also as the shape of a curled form or a grid etc.

[20] The scouring pad 21 made of resin is stuck on the surface plate side. With the polish liquid (supplied from the nozzle head of drawing 4 (b)) supplied from the polish liquid feed holes 6, it is supplied on the slot made by sticking it as a scouring pad 21 learns from the front face of the slot processed on the front face of a surface plate 20. A scouring pad 21 may be stuck to slot 22 inside of a surface plate, and it is not necessary to necessarily stick it, and it may be stuck in the condition that a clearance is between the slot 22 on the surface plate, and a scouring pad 21.

[21] It is because a processing load is not applied to the field of the scouring pad of a slot at the time of polish processing, so polish liquid is supplied along a slot. When sticking a diamond wheel on a surface plate and considering a barrel-polishing object, it is good for the above slots to be able to be made to do the piece of a diamond wheel to work.

[22] The thing which made pure water or alkaline liquid distribute the cerium oxide whose average abrasive grain is micrometers - about 2 micrometers, a diamond abrasive grain, a silicon carbide abrasive grain, an alumina abrasive grain, a zirconia abrasive grain, a manganese oxide abrasive grain, an iron-oxide abrasive grain, etc. as an abrasive material used for implementation of the polish approach of this invention, and the colloidal silica whose mean particle diameter is 0.02 micrometers - about 0.2 micrometers can be used. Moreover, bonded abrasive, such as a diamond wheel, may be used.

[23] As a scouring pad holding the abrasive material of this invention, the thing of the shape of a sheet, such as a pad of the suede made from urethane, a pad made from urethane foam, and a pad of a nonwoven fabric, can be used. Furthermore, you may be a scouring pad with a slot by machining or the heat press.

[24] The double-sided polish equipment of this invention of drawing 1 is the gestalt of the 1 operation which supplied polish liquid from the barrel-polishing object 2a side. In the side which is not supplied [ that polish liquid is supplied, 1 ], a difference does not arise in the amount of machining allowances of a ground disk. The glass disk and aluminum disk for magnetic-recording media by which a ground disk is used for a magnetic recording medium (HDD) are used suitably.

[25] This invention is explained in full detail according to an example below.

The diameter of 65mm and inner circumference performed [ the diameter of a periphery ] polish processing whose machining allowance is 0.05-10 micrometers using the double-sided polish equipment shown in example 1 drawing 1 out the glass disk of the shape of a doughnut of 20mm and alumino silicate glass with a thickness of 0.65mm. The specification and polish conditions of the used double-sided polish equipment are as follows.

[26] 1) Barrel-polishing object : what stuck the scouring pad (first ball-race incorporated company product name gal 1900) of the suede made from urethane on the surface plate made from stainless steel with a diameter of 70mm. Surface plate : as shown in drawing 4, six slots whose cross sections with a width of face [ of 5mm ] and a depth of 1mm are R configurations were prepared.

From the polish liquid feed holes prepared in one revolving-shaft alignment of a supply: barrel-polishing object through the slot from the supply axial center of polish liquid, mean particle diameter supplies per minute 3-10ml of slugs which made pure water distribute the cerium oxide which is about 1 micrometer.

number [ of a barrel-polishing object ] of rotations: -- number [ of a 800rpm5 glass disk ] of rotations: -- thrust [ of a 300rpm6 barrel-polishing object ]: -- about 5 kgf(s)7 polish time amount: -- distance [ of the center of rotation of 1 minute glass / 8 / disk, and the revolving-shaft alignment of a barrel-polishing object ]: -- distance a: from the glass disk peripheral face of the revolving-shaft alignment of 25mm9 barrel-polishing object -- an outside -- 11.5mm [0027] The evaluation result of polish conditions and polish is collectively shown in Table 1. At this time, the machining-allowance

iation of a glass disk measured about 1.5mm places of the glass disk before and behind polish. From the example 1 of Table 1, the distance a from the glass disk periphery of the revolving-shaft alignment of a barrel-polishing object was able to perform polish of 7.2 micrometers of machining allowances by polish rate 7.2 micrometer/min outside at the time of 11.5mm. Moreover, when the machining-allowance variation in the glass disk at this time measured 12 in a glass disk, it turned out that it is 0.1 micrometers or less.

28]

Table 1]

===== Example Polish conditions Evaluation of polish =====

----- A glass disk A barrel-polishing object Field of a machining allowance Polish rate Inner variation (micrometer) (micrometer/min) ----- Outer-diameter D1/ Compulsive rotation Diameter D revolving-shaft alignment Bore D2 A number and rotation D - (D1-D2) Glass circle (mm) Direction (mm) Board periphery \*\* -- distance a (mm) ----- (example)  
5/20 1000 70 Outside <0.1 7.2 The flattery direction 25 11.52 65/20 500 70 Outside <0.1 3.8 Hard flow 25 7.53 20 1000 70 To an outside <0.1 5.5 Hard flow 25 1.5===== [0029] In

Example 2 example 1, the rotational frequency of a glass disk was set to 500rpm at the reverse sense with the direction which carries out flattery rotation the barrel-polishing object, and the glass disk was similarly ground except having changed the location a from the glass disk periphery of the revolving shaft of a barrel-polishing object into 7.5mm outside. A result is shown in Table 1. The distance a from the glass disk periphery of the revolving shaft of a barrel-polishing object was able to perform polish of 3.8 micrometers of machining allowances by polish rate 3.8 micrometer/min outside from the example 2 of Table 1 at the time of 7.5mm. Moreover, when the machining-allowance variation in the glass disk at this time was measured like the example 1, it turned out that it is 0.1 micrometers or less.

30]

Table 2]

===== Example Polish conditions Evaluation of polish =====

----- A glass disk A barrel-polishing object Field of a machining allowance Polish rate Inner variation (micrometer) (micrometer/min) ----- Outer-diameter D1/ Compulsive rotation Diameter D revolving-shaft alignment Bore D2 A number and rotation D - (D1-D2) Glass circle (mm) A direction (mm) board periphery \*\* -- distance -- a (mm) ----- Example 1 of a comparison 65/20 It does not carry out. Outside 0.3 3.0 (Flattery rotation) 25 7.52 65/20 It does not Carry out, but is 40. To the inside 1.0 3.0 (flattery rotation) -5 7.5 ===== [0031] In example 3 example 1, the rotational frequency of a glass disk was set to 1000rpm at the reverse sense with the direction which carries out flattery rotation the barrel-polishing object, and the glass disk was similarly ground except having changed the distance a from the glass disk periphery of the revolving shaft of a barrel-polishing object into 1.5mm outside. A result is shown in Table 1. The distance a from the glass disk periphery of the revolving shaft of a barrel-polishing object was able to perform polish of 5.5 micrometers of machining allowances by polish rate 5.5 micrometer/min outside from the example 3 of Table 1 at time of 1.5mm. Moreover, when the machining-allowance variation in the glass disk at this time was measured like example 1, it was 0.3 micrometers.

32]

Table 3]

===== Example Polish conditions Evaluation of polish =====

----- A glass disk A barrel-polishing object Field of a machining allowance Polish rate Inner variation (micrometer) (micrometer/min) ----- Outer-diameter D1/ Compulsive rotation Diameter D revolving-shaft alignment Bore D2 A number and rotation D - (D1-D2) Glass circle (mm) A direction (mm) board periphery \*\* -- distance -- a (mm) ----- Example of comparison 3 (b) 65/20 It does not carry out. 70 Outside 0.25 4.5 (Flattery rotation) 25 1.5 (b) 65/20 It does not carry out. 70 Outside 0.2 3.0 (Flattery rotation) 7.5 (Ha) 65/20 It does not carry out. 70 To an outside 1.0 2.3 (flattery rotation) 25 5===== [0033]

Table 4]

===== Example Polish conditions Evaluation of polish =====

----- A glass disk A barrel-polishing object Field of a machining allowance Polish rate Inner variation (micrometer) (micrometer/min) ----- Outer-diameter D1/ Compulsive rotation Diameter D revolving-shaft alignment Bore D2 A number and rotation D - (D1-D2) Glass circle (mm) A direction (mm) board periphery \*\* -- distance -- a (mm) ----- Example of comparison 4 (b) 65/20 It does not carry out. 70 (Flattery rotation) 0.25 4.5 (Flattery rotation) 25 (b)s 65/20 It does not carry out. 70 (flattery rotation) 0.3 4.0

flattery rotation) 25 1.5 (Ha) 65/20 It does not carry out. 70 To an outside 0.5 3.3 (flattery rotation) 25  
 5===== [0034]

ble 5]

===== Example Polish conditions Evaluation of polish -----  
 ----- A glass disk A barrel-polishing object Field of a machining allowance Polish rate Inner variation  
 crometer) (micrometer/min) ----- Outer-diameter D1/ Compulsive rotation Diameter D  
 /olving-shaft alignment Bore D2 A number and rotation D - (D1-D2) Glass circle (mm) A direction (mm) board  
 iphery \*\* -- distance -- a (mm) ----- Example of comparison 5 (b) 65/20 It does not carry  
 . 70 To the inside 0.36.3 (Flattery rotation) 25 11.5 (b)s 65/20 It does not carry out. 70 Outside 0.3 5.0 (Flattery  
 tion) 25 7.5 (Ha) 65/20 It does not carry out. 70 Outside 0.6 4.3 (flattery rotation) 25 11.5

===== [0035] In example of comparison 1 example 1, the glass disk was  
 ilarly ground except having depended the rotational frequency of a glass disk on flattery rotation of a barrel-  
 ishing object, and having set distance a from the glass plate periphery of the revolving-shaft alignment of a barrel-  
 ishing object to 7.5mm. As a result was shown in Table 2, when the machining-allowance variation within the field  
 a glass disk was measured like the example 1, it was 0.3 and the polish rates were 3.0 micrometer/min.

36] In example of comparison 2 example 1, the glass disk was similarly ground except having set the diameter of a  
 rel-polishing object to 40mm, and having set distance a from the glass disk periphery of the revolving-shaft  
 nment to 7.5mm at the inner circumference side, and having made the barrel-polishing object carry out flattery  
 tion of the rotational frequency of a glass disk. As shown in Table 2, polish of 3.0 micrometers of machining  
 wances was able to be performed for the result by 3.0 micrometer/min. However, when the machining-allowance  
 iation of a glass disk was measured like the example 1, it was as big as 1.0 micrometers.

37] the distance a from the glass disk periphery of having not carried out forcible rotation of the glass disk, but  
 ing considered as flattery rotation in example of comparison 3 example 1, and the revolving-shaft alignment of a  
 rel-polishing object -- (\*\*) -- 1.5mm and (\*\*) -- except having been referred to as 7.5mm and 11.5 (Ha)mm, it was  
 de the same and the glass disk was ground. [ result / as shown in Table 3 / an example 1 ], the polish rate was also  
 / and the machining-allowance variation of a glass disk also became large.

38] the distance a from the glass plate periphery of the revolving shaft of having carried out flattery rotation of the  
 ss disk in example of comparison 4 example 2, and a barrel-polishing object -- (\*\*) -11.5mm and (\*\*) -- except  
 /ing been referred to as 1.5mm and 11.5 (Ha)mm, it was made the same and the glass disk was ground. About the  
 ult, as shown in Table 4, the machining-allowance variation of a glass disk became large.

39] the distance a from having carried out flattery rotation of the glass disk in example of comparison 5 example 3,  
 l the glass disk periphery of the revolving shaft of a barrel-polishing object -- (\*\*) -11.5mm and (\*\*) -- except having  
 n referred to as 7.5mm and 11.5 (Ha)mm, it was made the same and the glass disk was ground. About the result, as  
 own in Table 5, the machining-allowance variation of a glass disk became large.

40] As are explained above, and the example and the example of a comparison explained, by carrying out forcible  
 ation of the glass disk, and locating the location of the revolving-shaft alignment of a barrel-polishing object outside  
 periphery of a glass disk, and grinding it shows that a big polish rate can be maintained and the polish machining  
 wance of a glass disk can be made into homogeneity over the whole surface.

41] Moreover, in order to have carried out the polish machining allowance of a glass disk to homogeneity over the  
 ole surface, it turned out that it is good to make the radius (polish effective radius) of a barrel-polishing object larger  
 n the width of face of the direction of a path of a glass disk.

42]

Effect of the Invention] It faces according to this invention, inserting and showing with the barrel-polishing object of  
 pair which front flesh-side both sides of the ground disk which has the periphery of a diameter D1 and the inner  
 cumference of a diameter D2 were made to counter both sides of a ground disk, and established them to spite, and  
 nding to coincidence. Since (D1-D2) enlarged more the diameter D of the barrel-polishing object of the pair arranged  
 that it may have a revolving-shaft alignment parallel to the revolving-shaft alignment of a ground disk while carrying  
 t forcible rotation of the ground disk which carried out the maintenance means to the vertical posture At a big polish  
 e, the whole grinder-ed can be ground in uniform thickness.

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## AWINGS

Figure 1]

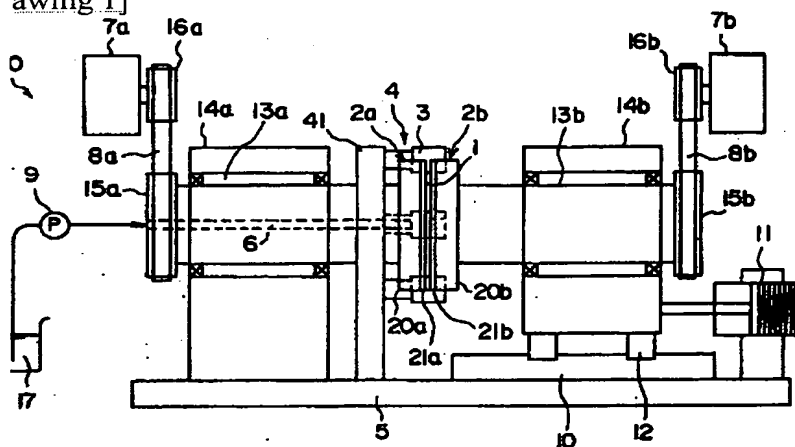


Figure 2]

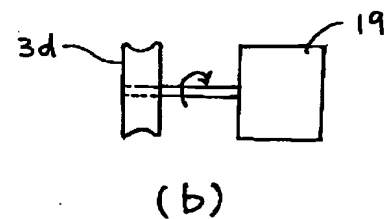
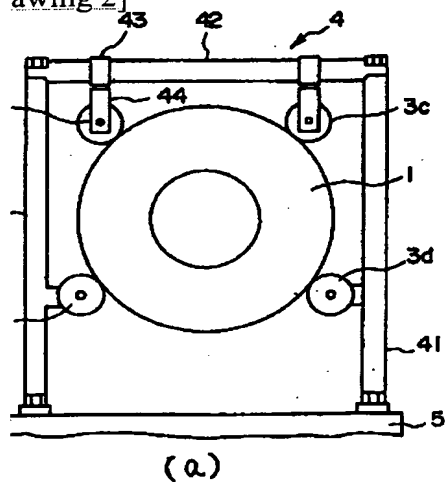


Figure 3]

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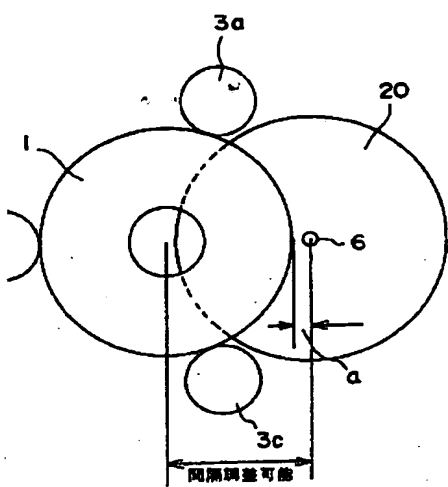
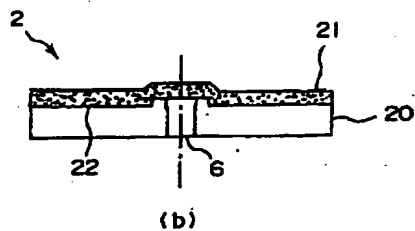
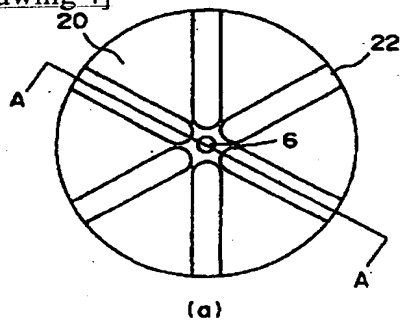


Figure 4]



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(71)出願人 000004008

日本板硝子株式会社

大阪府大阪市中央区道修町3丁目5番11号

(72)発明者 駒澤 聡亮

大阪府大阪市中央区道修町3丁目5番11号

日本板硝子株式会社内

(72)発明者 鈴木 弘一

大阪府大阪市中央区道修町3丁目5番11号

日本板硝子株式会社内

(74)代理人 100069084

弁理士 大野 精市

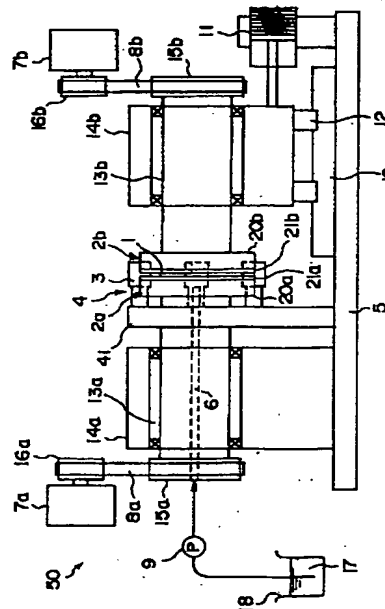
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(54)【発明の名称】 両面研磨方法および両面研磨装置

(57)【要約】

【課題】板厚みがより厚いガラス円盤の両面を同時に研磨して、磁気記録媒体用のガラス円盤に適した研磨方法として、研磨速度が大きく、かつガラス円盤の面全体を均一な取代で研磨する方法およびそれに適した両面研磨装置はなかった。

【解決手段】直径D1(65mm)の外周と直径D2(20mm)の内周とを有するガラス円盤の表裏両面を、ガラス円盤の両面に対向して設けた一對の回転研磨体で挟み当てつけて同時に研磨する研磨方法であって、ガラス円盤を縦姿勢保持手段により保持し、かつガラス円盤を強制回転させるとともに、一對の回転研磨体として、その回転軸心がガラス円盤の回転軸心に平行な回転軸心を有する直径D(たとえば70mmでD>D1-D2の関係を有する)の回転研磨体を用いて研磨する。



## 【特許請求の範囲】

【請求項1】直径D1の外周と直径D2の内周とを有する被研磨円盤の表裏両面を、前記被研磨円盤の両面に対向させて設けた一对の回転研磨体で挟み当てつけて同時に研磨する被研磨円盤の両面研磨方法であって、前記被研磨円盤を縦姿勢保持手段により保持し、かつ強制回転させるとともに、前記一对の回転研磨体を、その回転軸心が前記被研磨円盤の回転軸心に平行な回転軸心を有する直径D ( $D > D1 - D2$ ) の回転研磨体としたことを特徴とする被研磨円盤の両面研磨方法。

【請求項2】前記被研磨円盤の強制回転数を前記一对の回転研磨体の回転数より大きくしたことを特徴とする請求項1に記載の被研磨円盤の両面研磨方法。

【請求項3】前記一对の回転研磨体の回転軸心を前記被研磨円盤の外周の外側に配置したことを特徴とする請求項1または2に記載の被研磨円盤の両面研磨方法。

【請求項4】直径D1の外周と直径D2の内周とを有する被研磨円盤を縦姿勢に保持する手段と、前記被研磨円盤を強制回転する手段と、前記被研磨円盤の両面を挟むように配置され前記被研磨円盤の回転軸心に平行な回転軸心を有する一对の回転研磨体と、前記一对の回転研磨体の少なくとも一方を前記被研磨円盤に当てつける手段と、前記一对の回転研磨体の回転駆動機構とを有する両面研磨装置であって、前記一对の回転研磨体の直径Dが $D > D1 - D2$ であり、かつ、それらの回転軸心が前記被研磨円盤の外周の外側に配置されていることを特徴とする両面研磨装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、金属、セラミックス、ガラス等の円盤を、一对の回転研磨体を用いて同時に研削、研磨する方法およびその装置に関する。とりわけ、本発明は、磁気記録媒体に用いられるガラス円盤やアルミニウム円盤に好適な研磨方法および研磨装置に関する。

## 【0002】

【従来の技術】ガラス円盤の表裏両面を同時に研磨する方法としては、特開平6-210560号公報に、3つの円筒状の回転ローラでガラス円盤を縦姿勢に保持し、そのガラス円盤の直径よりも小さい直径を有する一对の回転研磨体でガラス円盤を挟み付けながら、回転研磨体を回転させるとともに、ガラス円盤の軸心に沿う回転軸心周りに往復運動させて、ガラス円盤の表裏両面を同時に研磨する方法および装置が記載されている。

【0003】また、特公昭61-10275号公報には、一对の回転研磨体のうち一方を回転研磨体の回転軸心に対して首振りしないようにし、他方を自在継ぎ手により回転研磨体の回転軸心に対して首振りするようにして、被研磨体の表裏両面を研磨する方法および装置が記載されてい

## 【0004】

【発明が解決しようとする課題】特開平6-210560号公報に記載されている方法では、回転研磨体の直径が被研磨体の直径より小さいため、また回転研磨体を被研磨円盤の軸心に沿う回転軸心周りに往復運動させて研磨するため、被研磨円盤の場所によって研磨速度の大小が生じ、被研磨円盤の面全体を均一に、かつ高速に研磨加工することが困難であるという課題があった。

【0005】また特公昭61-10275号公報に記載されている方法では、回転研磨体の一方を片軸で保持し、他方を自在継ぎ手により回転研磨体を回転軸心に対して首振り機構として被研磨体を研磨しているため、被研磨体にかかる圧力の分布が均一にならない。このため被研磨体への面全体を均一に研磨することが難しいという課題がある。さらに、被研磨体が回転研磨体により追従回転するため、研磨速度が低いという実用上解決すべき課題があった。

## 【0006】

【課題を解決するための手段】上記の課題を解決するためになされた本発明の両面研磨方法は、直径D1の外周と直径D2の内周とを有する被研磨円盤の表裏両面を、前記被研磨円盤の両面に対向させて設けた一对の回転研磨体で挟み当てつけて同時に研磨する被研磨円盤の両面研磨方法であって、前記被研磨円盤を縦姿勢保持手段により保持し、かつ強制回転させるとともに、前記一对の回転研磨体を、その回転軸心が前記被研磨円盤の回転軸心に平行な回転軸心を有する直径D ( $D > D1 - D2$ ) の回転研磨体としたことを特徴とする被研磨円盤の両面研磨方法である。

【0007】被研磨円盤の強制回転数は、一对の回転研磨体の回転数より大きくすることが、大きい研磨速度で、かつ被研磨円盤の全体にわたって均一な厚みで研磨する上で好ましい。

【0008】また、一对の回転研磨体の回転軸心は、被研磨円盤の外周の外側に配置することが被研磨円盤の全体にわたって均一な厚みで研磨する上で好ましい。

【0009】本発明の研磨装置は、直径D1の外周と直径D2の内周とを有する被研磨円盤を縦姿勢に保持する手段と、前記被研磨円盤を強制回転する手段と、前記被研磨円盤の両面を挟むように配置され前記被研磨円盤の回転軸心に平行な回転軸心を有する一对の回転研磨体と、前記一对の回転研磨体の少なくとも一方を前記被研磨円盤に当てつける手段と、前記一对の回転研磨体の回転駆動機構とを有する両面研磨装置であって、前記一对の回転研磨体の直径Dが $D > D1 - D2$ であり、かつ、それらの回転軸心が前記被研磨円盤の外周の外側に配置されていることを特徴とする。

## 【0010】

【発明の実施の形態】以下に本発明の実施の形態を図1～図4に基づいて説明する。図1は、本発明の両面研磨

装置の一実施例の全体図である。本発明の両面研磨装置50は、架台5と、この架台5の中央部に配置された被研磨円盤1を縦姿勢に保持する縦姿勢保持手段4と、この保持部4の両側に配置された回転研磨体2a、2bを含む。

【0011】ローラー3により縦姿勢に保持された被研磨円盤1の両面を挟むように、その回転軸心が被研磨円盤1の回転軸心と平行になるように、架台5の上に対の回転研磨体2a、2bが配置されている。

【0012】回転研磨体2aは、架台5に固定された軸受14aにより回転可能に支持された回転軸筒体13aに固定されている。支持具（図示しない）により固定された電動モーター7aの回転は、電動モーターの回転軸に取り付けられたプーリー16aと、プーリー16aと回転軸筒体13aの端部に取り付けられたプーリー15aをつなぐベルト8aを介して回転研磨体2aに伝えられる。回転軸筒体13aおよびプーリー15aの回転軸内には、貯蔵タンク18内の研磨液17を輸送ポンプ9により回転研磨体2a内部に供給するための研磨液供給孔6が設けられている。

【0013】回転研磨体2bは、架台5に設けられたレール10の上を左右方向に滑りながら移動するスライダ一部12に支持された軸受14bにより回転可能に支持されている回転軸筒体13bに固定されている。電動モーター7bの回転は、電動モーターの回転軸に取り付けられたプーリー16bと、プーリー16bと回転軸筒体13bの端部に取り付けられたプーリー15bをつなぐベルト8bを介して回転研磨体2bに伝えられる。

【0014】一對の回転研磨体2a、2bの少なくとも一方を被研磨円盤1に当てつける手段が設けられている。この当てつけ手段は、被研磨円盤1の研磨面に回転研磨体2を所定の圧力で押し当てる機能を有するものであれば特に限定されない。図1においては、軸受14を支えるスライダ一部12と、スライダ一部12を左右方向にスライドさせるレール10と、エアシリンダーを有する押圧装置11からなるものが示されている。押圧装置11のモーター駆動により回転研磨体2bは、被研磨円盤1に接近、離間が可能とされ、また適当な圧力で被研磨円盤1に当てつけられる。

【0015】図1において、回転研磨体2aは左右方向に固定され、回転研磨体2bは左右方向に当てつけ手段により移動可能である。被研磨円盤1は一對の回転研磨体2により押圧状態で当てつけられ、この押圧状態で研磨液が供給され研削加工、研磨加工が行われる。被研磨円盤1の縦姿勢保持手段4は、被研磨円盤1を少なくとも3個のローラーにより、その外周面が挟まれて保持される。

【0016】図2は、本発明の両面研磨装置の被研磨円盤1の縦姿勢保持手段4と強制回転用モーター19の一実施の形態を示す図である。図2(a)には、3つの回

転自在に取り付けられたローラー3a、3b、3cと一つの被研磨円盤を強制回転するローラー3dにより保持されている状態が示されている。各ローラー3の厚み（紙面に垂直な方向）の寸法は、被研磨円盤1の厚みの寸法より十分に大きい。各ローラー3の外周面には、被研磨円盤1の厚みより若干大きい幅の溝が、被研磨円盤1の保持手段からの取り外し、または保持手段の取り付けを容易にするために設けられてもよい。上側2つのローラー3a、3cは、横梁42を長さ方向に沿って滑るようにして移動可能に取り付けられた移動金具43を介して、支持金具44により、それぞれのローラーの回転軸心が水平になるように支持されている。下側のローラー3b、3dは、支柱41に取り付けられている。

【0017】図2(b)には、本発明の被研磨円盤1を強制回転する手段の一実施の形態が示されている。ローラー3dの軸は、強制回転用モーター19に連結され、ローラー3dの回転により所定の回転数で強制回転される。被研磨円盤1の強制回転は、少なくとも1つのローラーに取り付けた強制回転用モーターで行われる。

【0018】図3は、本発明にかかる内周の直径D2と外周の直径D1とを有する被研磨円盤1と回転研磨体2の回転軸心の位置関係を説明するための図である。図3には、被研磨円盤1が、その外周面に3つのローラー3a、3b、3cの外周面に挟まれて縦姿勢に保持された状態が示されている。一方の回転研磨体2aの回転軸心は、被研磨円盤1の回転軸心に平行に移動でき、距離aが調整可能なものとしてすることができ、回転研磨体2aの直径をDとしたとき、 $D > D1 - D2$ とされる。

【0019】本発明に用いられる、回転研磨体2は、金属製またはセラミックス製の定盤上に研磨パッドを貼りつけたものや、定盤の表面に所定粒度のダイヤモンド砥石を貼りつけたものを用いることができる。図4

(a)、図4(b)は、本発明に用いることのできる回転研磨体の一実施例の形態の平面図および断面図である。図4(a)では、金属製の円板20の片面には研磨液供給孔6につながる溝22が定盤の外周に向かって放射状に設けられている。溝22は渦巻き状や格子状等としてもよい。

【0020】定盤面には樹脂製の研磨パッド21が貼りつけられている。研磨液供給孔6より供給される研磨液（図4(b)の矢印から供給される）では、研磨パッド21が定盤20の表面に加工された溝の表面にならうようにして貼りつけられることによりできる溝の上に供給される。研磨パッド21は、必ずしも定盤の溝22内面に密着させて貼りつけておく必要はなく、定盤の溝22と研磨パッド21の間に隙間がある状態で貼りつけてあってもよい。

【0021】研磨加工時においては、溝部の研磨パッドの面には加工荷重がかからないために、溝に沿って研磨液が供給されるからである。定盤にダイヤモンド砥石を

貼りつけて回転研磨体とする場合は、貼りつけるダイヤモンド砥石片を上記のような溝ができるようにするのがよい。

【0022】本発明の研磨方法の実施に用いられる研磨剤としては、平均砥粒が $0.2\mu\text{m}$ ～ $2\mu\text{m}$ 程度の酸化セリウム、ダイヤモンド砥粒、炭化ケイ素砥粒、アルミナ砥粒、ジルコニア砥粒、酸化マンガン砥粒、酸化鉄砥粒等を純水またはアルカリ性の液に分散させたものや、平均粒径が $0.02\mu\text{m}$ ～ $0.2\mu\text{m}$ 程度のコロイダルシリカを用いることができる。また、ダイヤモンド砥石等の固定砥粒を用いてもよい。

【0023】本発明の研磨剤を保持する研磨パッドとしては、ウレタン製のスエードのパッド、発泡ウレタン製のパッド、不織布のパッドなどのシート状のものを用いることができる。さらに、機械加工や熱プレスによる溝付きの研磨パッドであってもよい。

【0024】図1の本発明の両面研磨装置は、回転研磨体2a側から研磨液を供給した一実施の形態である。研磨液が供給される側と供給されない側では、被研磨円盤の取代量には差が生じない。被研磨円盤は、磁気記録装置(HDD)に用いられる磁気記録媒体用のガラス円盤やアルミニウム円盤が好適に用いられる。

【0025】以下に本発明を実施例により詳述する。

#### 実施例1

図1に示す両面研磨装置を用いて、外周の直径が65mm、内周の直径が20mm、厚さ0.65mmのアルミノシリケートガラスのドーナツ状のガラス円盤について、取代が $0.05\sim 10\mu\text{m}$ の研磨加工を行った。用いた両面研磨装置の仕様および研磨条件は下記の通りである。

\*【0026】1) 回転研磨体：直径70mmのステンレス製定盤に、ウレタン製のスエードの研磨パッド(第一レース株式会社製品名シーガル1900)を貼りつけたもの。

2) 定盤：図4に示すように、幅5mm、深さ0.5mmの断面がR形状である溝を6本設けた。

3) 研磨液の供給

軸心から溝を経て供給：回転研磨体の一方の回転軸心に設けた研磨液供給孔から、平均粒径が約 $1\mu\text{m}$ の酸化セリウムを純水に分散させたものを、毎分3～10ml供給。

4) 回転研磨体の回転数：800rpm

5) ガラス円盤の回転数：1000rpm

6) 回転研磨体の押圧力：約5kgf

7) 研磨時間：1分

8) ガラス円盤の回転中心と回転研磨体の回転軸心との距離：25mm

9) 回転研磨体の回転軸心のガラス円盤外周面からの距離a：外側へ11.5mm

20 【0027】研磨条件と研磨の評価結果を表1にまとめて示す。このときガラス円盤の取代バラツキは、研磨前後のガラス円盤の12個所について測定を行った。表1の実施例1から、回転研磨体の回転軸心のガラス円盤外周からの距離aが外側へ11.5mmのとき、取代 $7.2\mu\text{m}$ の研磨を研磨速度 $7.2\mu\text{m}/\text{min}$ で行うことができた。またこのときのガラス円盤内の取代バラツキは、ガラス円盤内の12ヶ所を測定したところ $0.1\mu\text{m}$ 以下であることがわかった。

【0028】

\*30 【表1】

例 研磨条件				研磨の評価	
ガラス円盤		回転研磨体		取代の面内バラツキ ( $\mu\text{m}$ )	研磨速度 ( $\mu\text{m}/\text{min}$ )
外径D1/ 内径D2 (mm)	強制回転 数と回転 方向	直径D D-(D1-D2) (mm)	回転軸心 のガラス円 盤外周か らの距離 a (mm)		
(実施例)					
1	65/20	1000	70	外側へ	<0.1
		追従方向	25	11.5	7.2
2	65/20	500	70	外側へ	<0.1
		逆方向	25	7.5	3.8
3	65/20	1000	70	外側へ	<0.1
		逆方向	25	1.5	5.5

## 【0029】実施例2

実施例1とは、ガラス円盤の回転数を回転研磨体に追従回転する方向とは逆向きに500rpmとし、回転研磨体の回転軸のガラス円盤外周からの位置aを外側へ7.5mmに変えた以外は同じようにして、ガラス円盤の研磨を行った。結果を表1に示す。表1の実施例2から回転研磨体の回転軸のガラス円盤外周からの距離aが外側※

※へ7.5mmのとき、取代3.8μmの研磨を研磨速度3.8μm/minで行うことができた。またこのときのガラス円盤内の取代バラツキは、実施例1と同じように測定したところ0.1μm以下であることがわかった。

【0030】

【表2】

例 研磨条件				研磨の評価	
ガラス円盤		回転研磨体		取代の面内バラツキ (μm)	研磨速度 (μm/min)
外径D1/ 内径D2 (mm)	強制回転 数と回転 方向	直径D D-(D1-D2) (mm)	回転軸心 のガラス円 盤外周か らの距離 a (mm)		
比較例					
1 65/20	せず (追従回転)	70 25	外側へ 7.5	0.3	3.0
2 65/20	せず (追従回転)	40 -5	内側へ 7.5	1.0	3.0

## 【0031】実施例3

実施例1とは、ガラス円盤の回転数を回転研磨体に追従回転する方向とは逆向きに1000rpmとし、回転研磨体の回転軸のガラス板外周からの距離aを外側へ1.5mmに変えた以外は同じようにして、ガラス円盤の研磨を行った。結果を表1に示す。表1の実施例3から回転研磨体の回転軸のガラス円盤外周からの距離aが外側※

※へ1.5mmのとき、取代5.5μmの研磨を研磨速度5.5μm/minで行うことができた。またこのときのガラス円盤内の取代バラツキは、実施例1と同じように測定したところ0.3μmであった。

【0032】

【表3】

例 研磨条件				研磨の評価	
ガラス円盤		回転研磨体		取代の面内バラツキ (μm)	研磨速度 (μm/min)
外径D1/ 内径D2 (mm)	強制回転 数と回転 方向	直径D D-(D1-D2) (mm)	回転軸心 のガラス円 盤外周か らの距離 a (mm)		
比較例3					
(イ) 65/20	せず (追従回転)	70 25	外側へ 1.5	0.25	4.5

(6)

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9					10
(ロ)	65/20	せず	70	外側へ	0.2
		(追従回転)	25	7.5	3.0
(ハ)	65/20	せず	70	外側へ	1.0
		(追従回転)	25	11.5	2.3

【0033】

\* \* 【表4】

例 研磨条件				研磨の評価	
ガラス円盤		回転研磨体		取代の面 内径ラツキ ( $\mu\text{m}$ )	研磨速度 ( $\mu\text{m}/\text{min}$ )
外径D1/ 内径D2 (mm)	強制回転 数と回転 方向	直径D D-(D1-D2) (mm)	回転軸心 のガラス円 盤外周か らの距離 a (mm)		

比較例4

(イ)	65/20	せず	70	(追従回転)	0.25	4.5
		(追従回転)	25			
(ロ)	65/20	せず	70	(追従回転)	0.3	4.0
		(追従回転)	25	1.5		
(ハ)	65/20	せず	70	外側へ	0.5	3.3
		(追従回転)	25	11.5		

【0034】

※ ※ 【表5】

例 研磨条件				研磨の評価	
ガラス円盤		回転研磨体		取代の面 内径ラツキ ( $\mu\text{m}$ )	研磨速度 ( $\mu\text{m}/\text{min}$ )
外径D1/ 内径D2 (mm)	強制回転 数と回転 方向	直径D D-(D1-D2) (mm)	回転軸心 のガラス円 盤外周か らの距離 a (mm)		

比較例5

(イ)	65/20	せず	70	内側へ	0.3	6.3
		(追従回転)	25	11.5		
(ロ)	65/20	せず	70	外側へ	0.3	5.0
		(追従回転)	25	7.5		
(ハ)	65/20	せず	70	外側へ	0.6	4.3
		(追従回転)	25	11.5		

【0035】比較例1

50 実施例1とは、ガラス円盤の回転数を回転研磨体の追従

回転によるものとし、かつ回転研磨体の回転軸心のガラス板外周からの距離 $a$ を7.5mmとした以外は同じようにして、ガラス円盤の研磨を行った。表2に結果を示すように、ガラス円盤の面内の取代バラツキは、実施例1と同じように測定したところ、0.3であり、研磨速度は3.0 $\mu\text{m}/\text{min}$ であった。

#### 【0036】比較例2

実施例1とは、回転研磨体の直径を40mmとし、その回転軸心のガラス円盤外周からの距離 $a$ を内周側に7.5mmとしたこと、ガラス円盤の回転数を回転研磨体に追従回転させたこと以外は同じようにして、ガラス円盤の研磨を行った。結果を表2に示すように、取代3.0 $\mu\text{m}$ の研磨を3.0 $\mu\text{m}/\text{min}$ で行うことができた。しかし、ガラス円盤の取代バラツキは、実施例1と同じように測定したところ1.0 $\mu\text{m}$ と大きなものであった。

#### 【0037】比較例3

実施例1とは、ガラス円盤を強制回転せず追従回転としたこと、および回転研磨体の回転軸心のガラス円盤外周からの距離 $a$ を(イ)1.5mm、(ロ)7.5mm、(ハ)11.5mmとしたこと以外は同じにして、ガラス円盤の研磨を行った。結果を表3に示すように、実施例1と比較して研磨速度も低く、ガラス円盤の取代バラツキも大きいものとなった。

#### 【0038】比較例4

実施例2とは、ガラス円盤を追従回転したこと、回転研磨体の回転軸のガラス板外周からの距離 $a$ を(イ)1.5mm、(ロ)1.5mm、(ハ)11.5mmとしたこと以外は同じにして、ガラス円盤の研磨を行った。結果を表4に示すように、ガラス円盤の取代バラツキが大きいものとなった。

#### 【0039】比較例5

実施例3とは、ガラス円盤を追従回転したこと、および回転研磨体の回転軸のガラス円盤外周からの距離 $a$ を(イ)11.5mm、(ロ)7.5mm、(ハ)11.5mmとしたこと以外は同じにして、ガラス円盤の研磨を行った。結果を表5に示すように、ガラス円盤の取代バラツキが大きいものとなった。

【0040】以上説明したように、実施例と比較例で説明したように、ガラス円盤を強制回転させ、かつ、回転研磨体の回転軸心の位置をガラス円盤の外周より外側に位置させて研磨することにより、大きな研磨速度を維持して、ガラス円盤の研磨取代を全面にわたって均一にすることができることが分かる。

【0041】また、ガラス円盤の研磨取代を全面にわたって均一に行うには、回転研磨体の半径(研磨有効半径)をガラス円盤の径方向の幅よりも大きくするとよい

ことがわかった。

#### 【0042】

【発明の効果】本発明によれば、直径 $D_1$ の外周と直径 $D_2$ の内周とを有する被研磨円盤の表裏両面を、被研磨円盤の両面に対向させて設けた一対の回転研磨体で挟み当てつけて同時に研磨するに際して、縦姿勢に保持手段した被研磨円盤を強制回転させるとともに、被研磨円盤の回転軸心に平行な回転軸心を有するように配置した一対の回転研磨体の直径 $D$ を( $D_1 - D_2$ )のより大きくしたので、大きな研磨速度で、被研磨盤全体を均一な厚みに研磨することができる。

#### 【図面の簡単な説明】

【図1】本発明の両面研磨装置の一実施の形態の全体正面図である。

【図2】本発明の被研磨円盤の縦姿勢保持手段と強制回転手段の一実施の形態を説明する正面図である。

【図3】本発明の研磨方法にかかる被研磨円盤と回転研磨体の位置関係を示す図である。

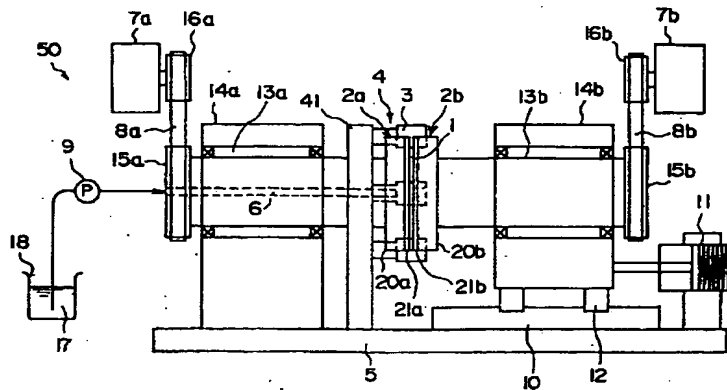
【図4】本発明の両面研磨装置の回転研磨体の一実施の形態の平面図および断面図である。

#### 【符号の説明】

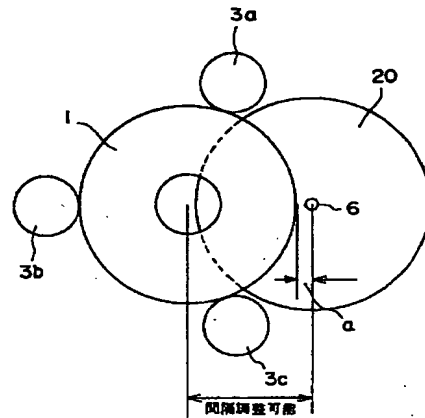
- 1：被研磨円盤
- 2：回転研磨体
- 3：ローラー
- 4：縦姿勢保持手段
- 5：架台
- 6：研磨液供給孔
- 7：電動モーター
- 8：ベルト
- 9：輸送ポンプ
- 10：レール
- 11：押圧装置
- 12：スライダ部
- 13：回転軸筒体
- 14：軸受体
- 15、16：ブーリー
- 17：研磨液
- 18：貯蔵タンク
- 19：強制回転用モーター
- 20：定盤
- 21：研磨パッド
- 22：溝
- 41：支柱
- 42：横梁
- 43：移動金具
- 44：支持金具
- 50：本発明の研磨装置



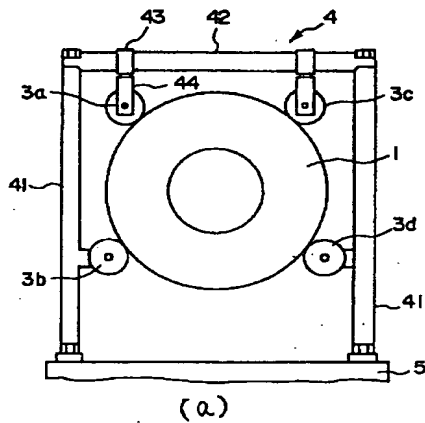
【図1】



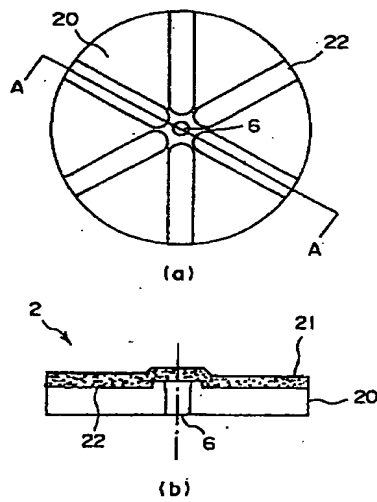
【図3】



【図2】



【図4】



(a)

(a)

(b)

(b)

【手続補正書】

【提出日】平成11年9月22日(1999.9.2)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】発明の名称

【補正方法】変更

【補正内容】

【発明の名称】 両面研磨方法および両面研磨装置

フロントページの続き

(72)発明者 菅野 篤哉  
大阪府大阪市中央区道修町3丁目5番11号  
日本板硝子株式会社内

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